

Hydrophobic-tailed bicycloisoxazolidines: A comparative study of the newly synthesized compounds on the inhibition of mild steel corrosion in hydrochloric and sulfuric acid media

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Abstract

The cycloaddition reactions of the cyclic nitrones 1-pyrroline 1-oxide and 3,4,5,6-tetrahydropyridine 1-oxide with alkenes, 11-phenoxy-1-undecene and 11-*p*-methoxyphenoxy-1-undecene, afforded cycloaddition products (bicyclic isoxazolidines) in excellent yields. One of the cycloadducts on reaction with propargyl chloride and ring opening with zinc in acetic acid afforded quaternary ammonium salt and aminoalcohol, respectively. All the new inhibitor molecules in the presence of 400 ppm at 60 °C achieved inhibition efficiencies, determined by gravimetric method, in the range 99–99.6% and 85–99% for mild steel in 1 M HCl and 0.5 M H₂SO₄, respectively. Comparable results were obtained by the electrochemical methods using Tafel plots and electrochemical impedance spectroscopy for the synthesized compounds. The isoxazolidine derivatives were also found to be good inhibitors of mild steel corrosion in synthetic brine. Negative values of ΔG_{ads} in the acidic media ensured the spontaneity of the adsorption process. While the corrosion inhibition by these molecules was predominantly under cathodic control in 1 M HCl, the inhibition in 0.5 M H₂SO₄ was found to be under anodic control. The isoxazolidines and their derivatives were found to be among a rare class of molecules, which provide suitable inhibition mechanism for the corrosion inhibition in HCl as well as in H₂SO₄ media.

Keywords: A. Isoxazolidine; A. Mild steel; A. Acidic medium; A. Nitrones; B. Polarization curves; C. Corrosion inhibitors